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REPORT OF SOYBEAN INDUSTRIAL CONFERENCE HELD AT THE NORTHERN REGIONAL RESEARCH  
LABORATORY, PEORIA, ILLINOIS, FEBRUARY 27-28, 1947 //

The meeting was attended by representatives of the U. S. Department of Agriculture, the Agricultural Experiment Stations, the soybean growers, the processing industry, and manufacturers of such consumer items as margarine, shortening, and protective coatings. Dr. G. E. Hilbert, Director of the Northern Regional Research Laboratory, welcomed the participants and explained the reasons for holding these sessions. The objective was first to obtain the views of all the representatives of the growers and industrial groups regarding the technological problems which the soybean industry will face during the next five to ten years. Using these problems as a basis, it was desired that the representatives of the various scientific research organizations then could plan the course to be followed in order to find answers to at least the most important of these questions.

The meeting then was turned over to Dean H. P. Rusk of the Illinois Agricultural Experiment Station who acted as chairman.

The prepared manuscripts which served as bases for the ensuing discussions will be printed in The Soybean Digest.

PRESENTATIONS BY OFFICIALS OF THE U. S. DEPARTMENT OF  
AGRICULTURE AND OF THE SOYBEAN INDUSTRY

"Present Status of Soybean Production Here and Abroad and Possible Competition From Other Oilseeds," by Robert M. Walsh, Special Assistant to the Chief, Bureau of Agricultural Economics, U. S. Department of Agriculture:

It was pointed out that before the war China was the largest producer of soybeans in the world, growing approximately 200 million bushels per year, and that Manchuria was second with an annual production of about 150 million bushels per year. The United States was next in importance, and the production here amounted to 90 million bushels in 1939.

In the United States the production of soybeans and the utilization of soybean oil made their greatest gains during the 1930's, during which time the ratio of soybean prices to corn prices was approximately 1.8:1. The principal competitor of soybean oil during this interval, as well as at the present time, was cottonseed oil.

In 1940, during the early months of World War II, prices of fats and oils remained low because our supplies were quite large, the surpluses being aggravated to some extent by naval blockades which prevented any appreciable share of the world's production being imported into Europe. By 1942, however, our own imports were interrupted. These had amounted to about 2 billion pounds per year during the 5 years 1937-41. Among the losses were coconut oil,



palm oil, and tung oil from the Orient, olive oil from the Mediterranean, and fish oil from northern Europe. These decreases were partially offset, however, by increased acquisition of sunflower and rapeseed oils from Argentina. Not much additional oil was obtained from other parts of South America, though, because most increases in production were consumed locally. The amount of babassu oil obtained from Brazil was rather small.

In anticipation of these shortages at home, our Government in 1941 relaxed restrictions on production and offered inducements to farmers to grow more oilseeds. Rationing was also instituted in 1942. The high production goals in 1942 for soybeans, linseed, and peanuts were largely responsible for increasing domestic production of fats and oils from 8.7 billion pounds in 1941 to 10.7 billion pounds in 1942. Peak production was 11.2 billion pounds during the 1943 marketing year. The production of soybean oil increased from 0.5 billion pounds in 1940 to 1.2 billion in 1942 and 1.4 billion in the 1945-6 season.

The United States became a net exporter during 1943-4 and continued as such through the first half of 1946. The civilian consumption of edible fats, which amounted to 46 pounds per capita during the period 1937-41, decreased to 40 pounds in 1945. In the same year the consumption of fats and oils for non-food uses was 24 pounds per person.

During the war the large amount of meal produced by processing the soybean crops was used principally for feeding livestock, and approximately 1.5 million bushels per year was utilized for manufacturing full-fat flour, and 5 million in the production of low-fat flour.

At present the shortage of fats and oils is world-wide, being worst in Germany and Austria. In prewar years, the European production amounted to 10 billion pounds per year and was augmented by importation of 5 billion pounds. In 1947 it is estimated that production in Europe will be only 8 billion pounds and that only 2 billion pounds will be imported. To meet demands throughout the world, 14 billion pounds of fat or its equivalent in oilseeds is needed for export during 1947, but only 6.3 billion pounds is available.

After World War I, approximately 8 years were required to restore the production of hogs to normal in Europe, and it seems certain that the livestock industry there will not be rehabilitated until at least 1950. Many areas in other parts of the world are still not producing at capacity.

Although the United States again became a net importer of fats during 1946, the import balances will be small for some years to come, approximately 1/5 to 1/4 the prewar balances during 1947. On the other hand, domestic production of fats will be about 1 billion pounds more during 1947 than in prewar years. Without increasing our stocks, approximately 64 pounds of fats and oils per capita can be made available during this year compared with 70 pounds in 1941. During the last few months of 1947 and the first 9 months of 1948, however, increases are expected in the production of soybean oil, linseed oil, and hog fats. These should cause a decline in prices, but the continued failure of supplies to meet requirements should keep prices substantially higher during the next 4 or 5 years than they were during the 1930's.

Because of heavy demands and attractive prices for fats and oils, production is being expanded in other parts of the world, particularly in the tropical plantations. It is believed that the supplies thus made available will become approximately equal to the demand in about 4 or 5 years and that, during the 5 years following this event, world trade will return to normal, with supplies being much more commensurate with the needs of the world. Within 10 or 15 years, however, serious surpluses are expected, with consequent depressing effects upon the prices of all fats and oils.

It was also emphasized that, domestically, corn will remain one of the chief competitors of soybeans and that, when corn is relatively cheap, the farmers will tend to feed more of it and less soybean meal. Thus, the necessity was indicated of impressing upon farmers the value of feeding ample quantities of protein even when corn is cheap.

During the discussion of this paper, inquiry was made regarding the probable domestic production of fats and oils during 1947 and 1948, and Mr. Walsh estimated these to be approximately 9.25 and 10 billion pounds, respectively. Dr. Norton expressed some doubt that production of these magnitudes will be realized.

Mr. Scheiter inquired regarding the effect on prices when import and export restrictions are terminated. Mr. Walsh said that import controls are scheduled to expire on April 1 of this year (export controls on June 30) and that, if they do, the result will be a chaotic situation, with many countries competing for the world's meager supplies and bidding the prices to higher levels. It was stated, however, that President Truman has requested continuance of the controls in order to prevent large quantities of our oil from being sold abroad, for the world price is considerably above that in this country. Mr. Scofield mentioned the possibility that such high competitive bidding might not occur, citing as an example the recent case in which linseed oil from Argentina, when made available to all American buyers equally, could not be sold at Argentina's price of 38 cents per pound, which was 3-1/2 cents above the price of the domestic product, even though there is an extremely critical shortage of linseed oil at the present time. Both Mr. Scheiter and Mr. Walsh expressed the belief that, although Europe is impoverished, money is available there to purchase large quantities of our oilseeds both for obtaining food supplies and for providing farmers with feed for their livestock. The political pressure in these countries to procure these necessities is enormous.

"Place of Soybeans in the American Agricultural Program," by Charles F. Brannan, Assistant Secretary of Agriculture:

Mr. Brannan commenced his remarks by emphasizing that the Department desires that its programs, particularly the program for soybean production and marketing, be that of the people concerned and that he welcomed this opportunity to discuss the subject with the participants at this meeting and to obtain their views. He emphasized that much of the planning of the Department is based on the expiration on December 31, 1948, of the Steagall Amendment and that after this time the question is, "Where do we go from here?" He also pointed out the difficulties often encountered in executing a price support



program, citing as an example the present situation with regard to the production of potatoes. The goal for 1946 was based upon expected demands, but the production per acre was very much greater than anticipated because of the use of new insecticides and more fertilizer.

Most of the problems facing the soybean industry, according to Mr. Brannan, are the result of the war. It became necessary to adopt the Steagall Amendment in order to provide farmers assurance that no disastrous collapse of prices would occur if they complied with the Department's request for large production.

The question of support prices was then discussed, and it was pointed out that the floor for 1942 beans was \$1.60 and that it was increased to \$1.80 in 1943. The 1944 and succeeding crops have been supported at a price of \$2.04 per bushel, and there has been much speculation on the support price to be set for the forthcoming harvest in the fall of 1947. It was explained that the announcement of this price was planned to coincide with this conference and that it would be \$2.04 per bushel, the same as last year. In announcing this decision Mr. Brannan stated that officials of the Department feel that the present demand so far exceeds the supplies that there is practically no possibility of prices declining to the support level. In such an unlikely event, however, the Department will engage in a program of loans and purchases. The present "comparable" price is approximately \$2.06 per bushel.

Mr. Brannan then reviewed some of the other wartime developments, including the programs adopted to assure complete processing of the large crops harvested during 1942 and in later years. He pointed out the impossibility of increasing the processing capacity rapidly enough to keep pace with the expanded production and, consequently, the necessity of shipping large quantities of soybeans into the South and into other sections of the country where surplus processing facilities were available. The soybean processing industry has now increased its capacity to 185 million bushels per year, however, so that practically any size of crop can be handled without difficulty. Approximately 3 percent of the production is now crushed outside the soybean producing area.

Another wartime program described briefly was the purchase of soybeans, commencing in 1943, on the basis of their oil content. Although the advantages of following such a procedure in the future are quite obvious, there is an urgent need for an analytical method to determine the oil content of soybeans simply and quickly--one that can be used by country receivers.

The role played by soy flour in feeding our civilian population as well as our allies and people in liberated countries was described. During the war we exported 112 million pounds of full-fat flour, 368 million pounds of the low-fat flour, and 177 million pounds of soy grits.

It was then pointed out that the tremendous requirements for fats and oils have led the Department to call for the largest acreage of soybeans on record during 1947, namely 11,244,000 acres. It is difficult to predict the needs for 1948 at the present time, but Mr. Brannan said he believes a modest reduction in acreage might be advisable next year.



Mr. Brannan said that he doubts whether the Department will adopt any kind of acreage controls because they have proved most unpopular both inside and outside the Department. He also explained that, so far as officials of the Department can predict, soybeans will continue to be classed as a soil-depleting crop when harvested for beans.

It was also pointed out that the possibilities for selling soybeans abroad are tremendous at the present time and that we could resort to exporting whenever we so desired if it should seem necessary in order to bolster prices at home. In this connection, Mr. Brannan described some of the recent developments within F.A.O. and stated that this group is now urging the formation of a World Food Council to assist the I.E.F.C., which body replaced the Combined Food Board. Plans have also been formed for the creation of a famine reserve as well as the procurement of so-called "buffer stocks" for use in stabilizing prices. As part of these programs, 110,000 tons of oilseed meal produced in the United States was recently allocated to Europe.

Mr. Brannan concluded by attempting to answer a number of questions regarding the future not only of soybeans but also of other agricultural commodities. The goal of the Department's programs is to make certain that the maximum productivity of agriculture can be employed for the benefit of all the people in the United States without having unexpected surpluses which cause ruinous declines in prices. It is hoped that this goal can be attained by the continuation of full employment, by the increase in demand caused by growth in our population, and by our participation in world trade. The attainment of these objectives is the object of the Research and Marketing Act of 1946, which provides for studies of more efficient production, new uses for agricultural commodities, the development and introduction of new types of plants, and the improving of marketing practices. The provisions of this Act are extremely broad and even allow, for example, the conducting of research by contract with other governmental or with private research institutions. Mr. Brannan asked for the cooperation of agriculture and industry in the implementing of this new Act.

During the discussion following Mr. Brannan's talk, Mr. Bunnell asked whether the Department is familiar with the views of individual farmers regarding the advisability of planting soybeans this year and whether those views indicate probable success in attainment of the production goal. Mr. Brannan's reply was, "Yes"; but he stated that the Department, because of financial limitations, would not be able to offer a support price any higher than that announced. He emphasized, however, that the prospects are for such a strong demand for the next year there is little likelihood of any break in prices. He also mentioned the support prices being offered for flaxseed, namely, \$6.00 per bushel in Minneapolis for U. S. No. 1, compared to \$3.60 last year. The flax goal is 5 million acres, and it is hoped that this will be realized in order to alleviate our present critical shortage of linseed oil and also to make this country independent of Argentina for its supplies.

Dr. Norton inquired whether expiration of the Steagall Amendment on December 31, 1948, would mean that crops harvested earlier but marketed later would be sold without support. Mr. Brannan replied that the Department feels that the

Steagall Amendment is intended to apply to the entire crop harvested or planted before expiration of the enabling act, regardless of when it might be marketed, but he emphasized the fact that these details would have to be arranged later.

Mr. McLaughlin stated his belief that soybean acreage will decrease this year, and Dean Rusk mentioned the present concern of farmers over the erosion caused on many fields by continued high production of soybeans.

Mr. Scofield pointed out the desirability of marketing soybeans in such a way that varieties containing oil suitable for industrial uses could be kept separated from those suited to the production of edible oils.

Dr. Norton also expressed a belief that the production goal will not be attained this year, at least in Illinois, but that the announced low support price is not a factor in causing this probable decrease in production. Neither is the price relation between corn and soybeans a factor. The present price of corn, he pointed out, is \$1.45 a bushel, compared to \$3.37 per bushel for soybeans. The ratio between these prices, namely 2.3, is quite favorable for soybean production.

"Problems in the Growing and Marketing of Soybeans," by W. W. McLaughlin, President, American Soybean Association:

Mr. McLaughlin reviewed the history of soybean production and pointed out a number of the reasons why the crop has become so important. One of these was solution of the weed problem by using proper machinery for preparation of the seed-bed and for cultivating the growing crop. The introduction of labor-saving machinery has also been an important factor, for the production of a bushel of soybeans now requires only 10 man-minutes, compared to 50 during the 1920's. These developments have caused a decrease in the cost of production and, consequently, more profit to the farmer, and the following figures were cited as evidence of this trend.

Years:	Cost of production, per acre	Yield, bu./A.	Cost of production, per bu.	Market price, per bu.	Profit or loss, per bu.
1922-24:	\$29.31	16.4	\$1.47	\$1.39	\$-0.08
1938-40:	15.37	28.7	0.56	0.69	+0.13
1943-45:	20.45	24.3	0.84	1.96	+1.12

It was pointed out that the future of soybeans depends upon the price received for the crop as compared with the prices received for competing farm products. In the past it has been assumed that the ratio of soybean prices to those of corn must be 2.0 or 2.5 to 1 in order to make profitable the growing of



soybeans. These prices depend, of course, on what the ultimate consumer is willing to pay as well as on numerous other considerations, including such factors as margarine taxation and importation of competing oilseeds or oils. Mention was made of certain economic studies indicating that the price of soybeans varies approximately 22 cents per bushel for each change of 1 billion dollars in the total income of individuals in the United States and that there is also a fluctuation of 15 cents per bushel in the price of soybeans for each change of 1 percent in the supplies of feeds available for livestock. Mr. McLaughlin expressed his belief that the increasing supplies of fats and oils resulting from the high production goals in 1947 will bring about a decline in the price of soybeans as compared to that of corn.

The speaker also stressed the need for research on the proper method of applying fertilizer in order to make soybeans less depleting to the soil. The problem, he stated, is not simply the proper method of fertilizing soybeans, but, instead, the judicious application of fertilizers throughout the rotation in order to make the soil capable of producing soybeans without impoverishment. He expressed his belief that research on the proper fertilization of all components of a rotation will make it possible to grow soybeans without depleting the soil. He emphasized that there is no substitute for a well-planned rotation, including clover, and that soybeans are not a substitute for clover when harvested for beans.

The advantages and disadvantages of a number of rotations were then discussed, and mention was made of several cultural practices which have proved quite advantageous. Planting in rows, for example, has been found to increase the cost of production slightly but to decrease the cost of the seed. The same practice minimizes erosion, lodging, and the growth of weeds. The use of a furrow opener ahead of the planter has also been found helpful.

In conclusion, Mr. McLaughlin listed the following problems upon which additional research is needed in order to help soybean growers raise this crop profitably.

1. Further study of the preparation of seed-beds, such as disking without plowing and similar practices.
2. Development of better inoculants.
3. Study of the optimum manner for fitting soybeans into various crop rotations.
4. Investigation of special problems, such as those relating to types of soil and topography of the fields.
5. Cultural practices, such as time of planting and width of rows.
6. Soil conservation practices, such as contouring.
7. The proper use of fertilizers so that a rotation including soybeans will not prove soil-depleting.
8. The best method of harvesting fields planted in various ways.
9. Studies of defoliation and hail damage.
10. The study of trace elements.
11. Improvement of storage practices.
12. Continuance of studies on the cost of production, such as those conducted by the Illinois Station.



During the discussion of this paper Dr. Milner asked whether it is conceivable that farmers would ever grow soybeans for the sole purpose of achieving a good crop rotation. Mr. McLaughlin replied that he doubted such a possibility. He emphasized that the farmers want a cash crop and that they probably would not plant soybeans unless the prospects for a good cash return were good. He cited two common rotations which compete with each other on many farms, namely, (1) corn, corn, oats, clover and (2) corn, soybeans, oats, clover. In rotations such as these the competition is plainly between corn and soybeans, and the cash return for the corn crop usually would far outweigh any advantages that might be obtained by planting soybeans under such conditions that there would be no cash return for this crop.

Dr. Beeson confirmed the view that the competition for acreage is primarily between soybeans and corn but stated that in some rotations the competition is between soybeans and oats. He also stated his opinion that Indiana will not reach its production goal this year.

Dr. Beeson also deplored the propaganda that has been spread widely to the effect that the production of soybeans should be curtailed as a soil conserving measure. He feels that very little advantage could be obtained, if any, by taking soybeans out of production and that the proper answer to this question is a positive program of growing soybeans while, at the same time, proper care is taken of the soil.

Dr. Carroll brought up the fact that in the so-called "fringe" area around the corn belt the ratio of the yields of soybeans and corn is often far more favorable to soybeans than it is in the heart of the soybean producing area, and he asked whether this factor might cause a greater shift in soybean production to these "fringe" regions. A discussion then ensued regarding the corn yield as compared to soybean yield in various districts, and Dr. Burlison cited figures indicating that the ratio is 3:1 in northern Illinois, 2-1/2:1 in the central part of the state, and 1-1/2:1 in southern Illinois. Others volunteered data indicating that the ratio is 3-1/2:1 in northern Iowa and 2:1 in the southern half of that state. Dr. Keim stated that Nebraska is one of the states in which soybean yields appear rather favorable when compared with those of corn, but he stated his doubts whether soybeans are likely to increase in importance in comparison with corn. Mr. Morse pointed out that in Oklahoma and in some other parts of the South the yield of soybeans per acre exceeds that of corn. It was also emphasized by Dr. Norton, however, that one-year yields should not be compared but that the comparison should cover the entire rotation, including the yields of the other crops which are alternated with the soybeans and corn.

"Present Status and Future Problems in Soybean Processing," by D. J. Bunnell, Chairman, Executive Committee, National Soybean Processors Association:

This discussion was opened with a description of the growth of the soybean processing industry during the 1930's and of its rapid expansion during the war. The present processing capacity is approximately 175 million bushels of soybeans per year, and present construction will increase this to 190 million bushels. These facilities would be able to handle even larger crops than have been produced during the past few years.

The speaker mentioned briefly the possibilities of employing new fractionating procedures for separating the oil into fractions which are more suited to specific uses than the oil now available, and he predicted large-scale employment of such processes in the future. These methods of fractionating the oil will prove particularly useful when competition from other oils becomes intense, probably two or three years hence.

The importance of distributing protein meal properly and utilizing it in the most efficient manner was stressed, and attention was called to the fact that this country has never produced enough protein to provide a proper balance in carbohydrate feeds. An aggravating factor has been the alleged decrease in the protein content of corn from approximately 9.5 to 8.5 percent during the past few years, necessitating the incorporation of larger amounts of soybean meal in mixed feeds.

An expanded usage of soy flour was also predicted, and it was recommended that more educational and advertising programs be conducted in order to develop consumer acceptance for this product.

The benefits of soybeans to farmers in the North Central States were described, particularly their use as a substitute for corn and oats in the cropping systems.

The most important subject discussed by Mr. Bunnell was the need for more orderly marketing procedures, that is, provision for greater storage on the farms so that the bulk of the crop is not dumped on the market in so short a time during the harvest season. Last year, for example, 120 million bushels or 60 percent of the crop was sold in six to eight weeks. Such a practice not only depresses the price, but it also taxes transportation and receiving facilities and burdens the receivers and processors with extraordinary financing difficulties. It was necessary for these receivers and processors to pay approximately \$360,000,000 for the 120 million bushels marketed during the harvest last fall, and a great deal of credit was necessary in order to finance these purchases. In some cases, processors may have difficulty in assuring their financiers of their stability and their ability to avoid undue market risks.

The result of such a heavy movement of soybeans at harvest time is a scramble on the part of the processor to sell his products, soybean oil and soybean oil meal, months ahead into the future. But the trade is not willing to contract these products in the kind of volume represented by the Fall soybean movement. The result is a declining market under pressure from heavy offerings. The Soybean Futures Market on the Chicago Board of Trade, when re-opened, will help this situation a great deal, but farmers should make some effort to hold back a portion of the crop, thereby enabling the soybean movement to be scattered better throughout the year. The processors would prefer to maintain inventories for a few months' grind, enough to protect continuous operations, instead of for nearly a full year.

Mr. Bunnell then discussed the trend of the processing industry toward solvent extraction, pointing out that the chief reason for this shift is the greater



efficiency of the solvent process. Expeller pressing, however, is better adapted to small-scale operations, and it is therefore unlikely that solvent extraction will replace the expeller process completely. The safety feature has been cited as a deterrent to the use of extraction, but Mr. Bunnell stated that insurance companies have paid a considerably larger amount for damages in expeller mills than in solvent plants during recent years.

The need for still greater efficiency in operation and for the adoption of practices which yield products of higher quality was also discussed. The speaker said that his own company has installed a small solvent extraction unit in the laboratory for use in studying extraction methods. During the war the processing mills ran at peak capacity and, as a result, experienced extreme wear and tear on their equipment. Much of this worn machinery must now be replaced, and such replacements will be made with more efficient apparatus. The less efficient mills consequently may be forced to close if they are not modernized. There may be exceptions, however, in the cases of mills which are situated advantageously so that a large proportion of their business consists in the direct trading with farmers.

In discussing this paper, Dean Rusk mentioned references to the fact that agricultural production in the South is being altered because of changes in the economic situation of that region. In his opinion, however, the reverse is true; for he feels that the economic changes are the result of new agricultural practices. He pointed out that to modernize a typical cotton plantation would cost approximately \$50 per acre, largely for the purchase of the machinery necessary to reduce hand labor.

Mr. Henson confirmed the tremendous change occurring in southern agriculture, particularly the replacement of cotton by soybeans in many areas.

Mr. Goss commented on the need for improving processing practices in order to produce oils of higher quality, emphasizing the fact that considerable crude oil now being marketed cannot be refined by any known procedure to yield a product which resists flavor reversion. He mentioned a number of abusive practices followed in American mills which European operators avoid. Mr. Bunnell pointed out that the European industry differs from ours in that most of the European processors also refine their own oil.

Mr. Houghtlin commented on the higher quality of American beans, as compared with those ordinarily processed in European mills. For that reason alone, European processors would have to take extra precautions in their processing operations.

Mr. Probst asked what proportion of the crop would be the preferred amount for farmers to store and whether the price received later in the season justifies the expense of storing beans on the farm. The consensus of several of those present was that the cost of farm storage was considerably less than the increase in price which usually occurs later in the season but that there was little incentive for such farm storage during the war because the price of beans under price controls remained relatively constant throughout the season. Dr. Norton stated that one reason for the rush of soybeans to market in the fall is that most farms do not have equipment for elevating soybeans into



storage bins, for the elevators used for corn will not handle beans. Dean Rusk asked for additional comments regarding the apparent decrease of protein in corn, and Mr. Scheiter replied that his company is experiencing considerable difficulty in maintaining the protein content of its gluten feed. It is customary to maintain 24 to 25 percent protein in this material, but recently it has been necessary to add greater and greater proportions of gluten meal in order to meet the minimum guarantee of 23 percent.

Dr. Hamilton commented that, for each 1 percent less protein in corn, there are required 2 pounds more of soybean meal for feeding each bushel of corn. Dr. Brownlee commented, however, that it is difficult to state what protein level should be used in feeding because the relative prices of corn and soybean oil meal govern the optimum level to use in order to get the best return for the investment in feed.

"Problems in the Use of Soybean Oil for Edible Purposes," by P. T. Truitt and G. A. Crapple, National Association of Margarine Manufacturers:

Mr. Truitt spoke only briefly, but very much to the point, emphasizing that margarine is a well-established, nutritious, and highly important article in the diet and that flavor is the greatest technological problem of the margarine industry. He cited figures showing the increase in the amount of soybean oil used in margarine during the past 10 years and said that, if the necessary supply of oils could be obtained, his industry could make and sell at least twice as much margarine as the 570 million pounds produced in 1946. The consumption of margarine by the average housewife has more than doubled since 1940.

Mr. Truitt stated that the margarine industry wants to use tremendous quantities of soybean oil but that it is not sufficiently stable in flavor to permit their making a product that will meet postwar competition when normal supplies of fats are again available. This problem is a most serious threat to the future of soybean oil and, consequently, of the entire soybean industry.

During the war, rapid turnover assisted in the control of flavor reversion, for the undesirable flavors did not develop too seriously during the relatively short time that margarine was in storage and on the grocers' shelves. In normal times, however, margarine will be required to withstand a shelf-life of six weeks.

The margarine manufacturers consider reversion to be by far their most important problem and are supporting research on it both at the University of Pittsburgh and in the laboratories of the individual members of the Association. Mr. Truitt asked that additional action be taken at this meeting to expedite research on reversion and warned that, by 1950, the soybean industry will be extremely sorry for its inactivity if research on this problem is not expedited immediately.

Mr. Crapple then made a plea for additional research on reversion and discussed some technical features of the problem. It was once considered impossible to use over one-third soybean oil as the fatty constituent of margarine, but the industry is now using about half soybean oil. This applies

not only in margarine but also in shortening and in salad dressings. He pointed out that the problem is considerably different in the cases of unhardened and hardened oils and that the margarine industry is interested primarily in the latter type. To his knowledge, no remedy has been found for flavor reversion in hydrogenated soybean oil, and until rather recently it was the practice to use soybean oil principally in the lower grade of competitive products.

Mr. Crapple then discussed the research being conducted under the sponsorship of the Association at the University of Pittsburgh, the principal objectives being:

1. Recognition of reverted flavors and the devising of means for producing them artificially.
2. Isolation and identification of both the substances responsible for reversion and their chemical precursors.
3. Developing methods for preventing flavor reversion.

Another type of study being conducted at the University of Pittsburgh is the production of synthetic oils similar to soybean oil in an effort to ascertain whether flavor instability is due primarily to the inherent fatty acids of soybean oil or to certain minor constituents. Mr. Crapple stressed the need for much more fundamental research on the chemistry of soybean oil from a flavor standpoint and called for additional work on the subject at the Northern Regional Research Laboratory. He pledged wholehearted cooperation of the margarine industry, which he represents, and also stated his belief that the shortening industry will be equally cooperative. The facilities of the plants of margarine manufacturers will be available for making tests of the results of any research conducted in response to his plea.

Dr. Manley opened a discussion of this paper by asking what could be done in the industries represented at the meeting in order to accelerate the work being conducted by the Northern Regional Research Laboratory on reversion. In spite of considerable discussion, no definite decision was reached.

Mr. Goss called attention to the methods used in Europe, the efficacy of which has been demonstrated at the Northern Regional Research Laboratory, for producing unhardened soybean oils which resist flavor reversion; and he asked why margarine manufacturers do not produce a blended product using those unhardened oils as is the practice in Europe. Mr. Crapple replied that the generally higher temperatures prevailing in this country prohibit the use of any appreciable quantities of unhardened oil in margarine.

Dr. Norton asked whether the research being conducted at this Laboratory on reversion is being coordinated and was assured that very close coordination is being maintained through the Soybean Research Council.



"Problems in the Use of Soybean Oil for Industrial Purposes," by Francis Scofield, National Paint, Varnish, and Lacquer Association:

Mr. Scofield stated that the use of soybean oil in industrial products can be classed in two categories:

1. The replacing of some oils, such as linseed oil, by soybean oil. In this case the soybean oil is intended to function in practically the same manner as the oil replaced and is therefore considered more or less as an adulterant. The paint and varnish industry normally uses approximately 1 pound of oil for every dollar of sales, and it can use soybean oil for approximately 10 percent of this quantity.
2. The production of some product for whose manufacture only soybean oil is ideally suited. Examples of this use include the production of alkyds and of plasticizers. The magnitude of these uses can be judged by referring to the data of the Census Bureau for consumption of soybean oil in protective coatings from 1942 to 1944, for during these years such uses of soybean oil were the only ones permitted outside the food industry.

In discussing problems facing the protective coating industry, Mr. Scofield said that the production of alkyds is more an art than a science and that considerable research should be done on this subject. He also pointed out the advantages of various fractionation processes, particularly furfural extraction and the use of extraction with acetone and similar solvents to separate polymers from monomers in partially bodied oils.

It was pointed out that soybean oil can be blended with tung and oiticica oils to produce protective coatings with good drying qualities, but such finishes are apt to wrinkle and are usually considered inferior.

The research problems of the paint and varnish industry may be classed as fundamental, applied, and developmental. Mr. Scofield recommended the conducting of additional research, especially on the fundamental problems, chief of which are the questions of glyceride composition and the mechanism through which the polymerization of oils is accomplished during drying. The applied research consists largely in trying to conduct, on a plant scale, reactions previously studied in the laboratory. Developmental research appears to be largely the promotion of consumer acceptance, and Mr. Scofield felt that this subject would not be of interest to this conference. He also stated that, in his opinion, the applied research is now being conducted satisfactorily by members of his industry. His plea was principally for more fundamental research of the type on which only a small beginning has been made by the Federation of Paint and Varnish Production Clubs. Their present projects include the preparation of synthetic compounds and a study of their use in protective coatings.

During the discussion of his paper Mr. Scofield repeated his plea for additional research on the composition of soybean oil. He also stated that the amount of soybean oil being consumed now in the drying industries is probably



somewhat less than 10 percent of the oils used because both soybean oil and linseed oil are extremely scarce; and soybean oil is rather high in price because of the strong demand created by the food industry.

"Problems in the Use of Soybean Oil Meal for Feed and Soy Flour for Food," by J. W. Hayward, Chairman, Soyfood Research Council:

Dr. Hayward introduced his subject by presenting a table showing the production of protein supplements during the period of 1930-47. In analyzing these statistics he pointed out that in many cases fish meal should be considered as a supplement and a complement of soybean oil meal.

At the present time at least 95 percent of the soybeans grown are either processed or used for seed. Of the soybean oil meal produced, approximately 95 percent is used in feeds. Before the war 3 percent was used in fertilizers, 1 percent in flour, and 1 percent for manufacturing adhesives, industrial proteins, and similar products. From 1930 to 1940 the production of soy flour amounted to about 25 million pounds per year, but its manufacture was increased greatly during the war. Government purchases amounted to 10 million pounds in 1941, 170 million in 1943, and 200 million in 1946. The total production for domestic consumption and government purchases amounted in 1946 to approximately 380 million pounds. About 40 percent of the domestic consumption is accounted for by bakeries, and 20 percent is used as a binder in meats, such use having been legalized by the Bureau of Animal Industry. The remainder is used in confections and for other miscellaneous purposes.

Dr. Hayward pointed out that the production of protein in this country is only half sufficient to provide really balanced rations for our livestock. During the 1945-46 crop year the production of protein supplements amounted to 9,028,000 tons, of which 3,630,000 tons was soybean oil meal.

Data were also presented to show the amino acid composition of various proteins and to indicate the superior quality of the protein in soybean oil meal. It is particularly high in its content of lysine, whereas the proteins in cereal grains contain little of this constituent. Cottonseed meal and linseed meal contain much less lysine than soybean oil meal.

In the feeding of animals with a single stomach, particularly poultry and young swine, soybean oil meal must be cooked properly. Raw soybeans or soybeans that have been overheated are inferior in their nutritive properties. When feeding these animals it is also necessary to supplement soybean oil meal with fish meal or similar proteins in order to provide the required amount of methionine. The need was indicated for developing a variety of soybeans containing a higher content of this essential amino acid, and Dr. Hayward stated that the Soybean Research Council plans to present a program for research on this subject.

Dr. Hayward also discussed the needs for the various vitamins in feeds, particularly riboflavin and other members of the B-complex. The need for adding minerals, particularly calcium, potassium, and iodine, was also stressed. In discussing various formulations for feeding soybean oil meal to different

animals, particular attention was called to the use of alfalfa leaf meal as a supplier of certain growth factors and to the need for more nutritional research on the feeding of hogs and poultry. Dr. Hayward feels, however, that no serious problems are presented by the feeding of cattle and sheep, although there is some possibility that urea may become a competitor of soybean oil meal for this application. It was stated that our hog population should receive approximately 3 million tons of soybean oil meal per year and that the analogous market in the poultry industry would be 800,000 tons per year.

The need was also pointed out for additional work to determine the proper factor to use when converting data on nitrogen content to express the percentage of protein in soy flour. The factor of 5.7 has been urged by some, but 6.25 is now used. Dr. A. K. Smith, of the Northern Regional Research Laboratory, however, has conducted experiments indicating that a more correct figure would be 5.9.

Dr. Hayward also stated that a method is needed for expressing quantitatively the exact function of soy flour in the manufacture of baked goods. The development of varieties better suited for the manufacture of soy flour would also be worthy of study. Still another problem recommended for investigation is a study of the manufacture of soy flour in order to improve the flavor and color of the product, decrease the content of thermophillic bacteria, and to improve quality in other respects. The need for additional development of consumer acceptance was also indicated.

The Soy Flour Association is now supporting considerable research on the preceding problems, and it was recommended that a meeting be arranged with the technical representatives of that Association if the Northern Regional Research Laboratory or any other research group represented at this meeting should undertake research of the type described.

In the discussion of this paper, Mr. Strayer pointed out that at least 90 percent of the soybean oil meal is still being sold to the farmer and that the continuation of this market depends upon the success of efforts to convince the farmer that it is good practice to use plenty of protein supplements even when the price of corn is low.

During the discussion, mention was also made of the weakening in the price of soybean oil meal during recent months, and some fear was expressed that the downward trend would continue. Dr. Norton asked how much less soybean oil meal is being sold this year than last and, similarly, how much less livestock is being grown this year than last. The answer was that the consumption of soybean oil meal is practically the same as last year, although there is probably some decrease because of the building up of stocks. The amount of livestock being grown, however, is definitely smaller, and Dr. Norton therefore expressed the belief that the consumer acceptance of soybean oil meal is at least as strong this year as last.



STATEMENTS BY REPRESENTATIVES OF RESEARCH GROUPS,

FEBRUARY 23, 1947

Dean Rusk opened the second session by reading a summary of the questions raised by speakers during the previous day and asked that those presenting talks during the ensuing session consider these questions when presenting information about their research programs and facilities.

"Report from the Bureau of Plant Industry, Soils, and Agricultural Engineering," by J. L. Cartter, U. S. Regional Soybean Laboratory:

Mr. Cartter introduced his subject by reviewing the history of the Regional Soybean Laboratory and its program of agronomic studies. The parent stock for the varieties developed in these investigations came from the Orient, many of them as a result of Mr. W. J. Morse's travel in Manchuria. Crosses are being made at 4 or 5 stations, and the better selections obtained from these crosses are being distributed to other stations to be tested for yielding ability and other agronomic characteristics. The Analytical Section of the Laboratory in Urbana studies the chemical composition of the seeds thus produced to find the strains of most value for industrial utilization.

A detailed description was given of the functioning of the Uniform Nursery Tests. Varieties have been developed which have good yield and high oil content for the northern portion of the Southern States. Other varieties have been developed which have a good oil content and grow well in the central part of the South. Crosses are now being made between these strains to obtain improvement in disease resistance as well as in agronomic characteristics.

The Lincoln soybean was cited as an example of the work of the Regional Soybean Laboratory in the North Central States. It is now grown on over half the acreage in Illinois and Indiana and is outstanding in many characteristics, particularly in yield and in oil content. It lodges to some extent, however, and generally matures too late to do well in the northern parts of Illinois and Indiana. A cross has been made between Lincoln and Richland to combine the high oil content and high yield of Lincoln with the earliness and lodging resistance of Richland.

Another recent product is a strain similar in yield and oil content to the Lincoln but of entirely different parentage. It is being increased because its resistance to disease may be considerably different from that of the Lincoln variety, and it seems wise to have a stock of such seed for use in case of an unexpected outbreak of some disease to which it may be resistant.

Part of Mr. Cartter's talk was devoted to a discussion of the research on diseases being conducted by the Division of Forage Crops and Diseases. Soybeans were once considered to be a crop free from diseases, but more recently a number of pathological ailments have been noted. Hoping to develop remedial measures before a serious need arises, a program of disease study was initiated at the Regional Soybean Laboratory several years ago, functioning in



close cooperation with the Experiment Stations. Twenty to thirty diseases have been observed, among which are bacterial pustule and downy mildew. Certain strains which are resistant to bacterial pustule are being crossed with high yielding varieties in order to develop desirable varieties with greater disease resistance.

Two very common diseases are bud blight and brown stem rot. The former is very destructive and is caused by a virus whose means of transmission has not yet been determined. Efforts are now being made to find possible insect vectors or other carriers. Brown stem rot, on the other hand, is a fungus which exists in the soil and which causes the leaves to wither between the veins. It causes the pith to turn brown, but the brown coloration starts at the ground and works up. Bud blight produces the same effect inside the stem except that the brown color starts at the leaves and works downward. Mr. Cartter recommended, where brown stem rot is encountered, that soybeans should not be followed by another crop of soybeans at intervals of less than 4 years.

A series of slides was then shown to illustrate the operation of the breeding studies and to show how various diseases affect the soybean plant. A picture was shown to demonstrate the not too favorable lodging characteristics of the Lincoln variety as compared with a new strain which appears adapted to production further north than the districts where Lincoln is now grown. The newer variety stands very erect.

It was said that the first clue toward control measures for brown stem rot was obtained by flying over the fields in Champaign County and noting demarcation lines between infected and uninfected areas in the same field. It was found, through discussions with the farmers concerned, that the infected areas were those on which soybeans had been grown at intervals of less than 4 years, whereas areas that were free of the disease had borne soybeans less frequently.

In a discussion of this paper it was asked whether any estimate can be made of the extent to which diseases are influencing yields. Both Mr. Cartter and Mr. Morse replied that the making of such estimates is extremely difficult but that it is their opinion that in some heavily infected fields yields have been reduced by as much as 50 percent.

Mr. E. F. Johnson, who attended in the place of Mr. Scheiter on February 28, objected to the recommendation of a 4-year rotation for controlling brown stem rot, stating that introduction of such a rotation would cut soybean production seriously because so much of Champaign County and adjacent areas is cropped on a 2-year rotation. He estimated that soybean production in these districts would be reduced by 40 percent by a 4-year rotation, and he urged that some other control measure be devised if possible. Mr. Cartter expressed his opinion, however, that such a change in rotations would not result in so drastic a curtailment of production and stated that in badly infected areas the higher yields obtained from a 4-year rotation might actually result in increased production over that obtained from a shorter rotation.

Mr. Scofield asked what progress had been made toward breeding varieties having exceptionally high and exceptionally low iodine values, and Mr. Cartter cited several examples of each. He also pointed out that low temperatures during the latter part of the growing season tend to produce a higher iodine value and vice versa. The new strain that has been developed for areas slightly north of those where Lincoln flourishes has a comparatively low iodine value, being about the same as the Dunfield variety in this respect.

It was asked whether refiners would be willing to pay any premium for an oil of lower iodine value, and Mr. Crapple answered that there is no justification for such a premium on the basis of present knowledge. He stated, however, that additional research is needed in order to determine whether soybean oil of low iodine value is less liable to revert.

Dr. Hayward stated that there is no reason now to breed for higher iodine values because fractionation processes will permit the separation of those constituents which are highly unsaturated. He urged that more consideration be given to the composition of the meal resulting from processing various new varieties.

It was pointed out that the Regional Soybean Laboratory and the Northern Regional Research Laboratory have underway a program for evaluating both the oil and meal obtained from various new varieties of soybeans before the seed is released for commercial production.

Mr. Scofield expressed his opinion that it would be futile to breed varieties having such special characteristics as exceptionally high or low iodine values unless a marketing procedure is developed for delivering these varieties unmixed with varieties of opposite characteristics.

"Report from Experiment Stations," by W. L. Burlison, Illinois Agricultural Experiment Station:

Dr. Burlison described the research projects being studied in the Agricultural Experiment Stations and stated that the number of such projects has increased from 206 in 1935 to 370 at the present time. These, some of which overlap, are classified, by departments, as follows:

Agronomy. . . . .	193
Animal Husbandry and Dairy Husbandry. . . . .	135
Horticulture. . . . .	25
Chemistry . . . . .	17
Home Economics. . . . .	17
Botany, Physiology, Ecology . . . . .	13
Agricultural Engineering. . . . .	8
Entomology. . . . .	5
Pathology . . . . .	5
Bacteriology. . . . .	4
Agricultural Economics. . . . .	3



This list does not include any projects of the U. S. Department of Agriculture, although some of those included are being conducted in cooperation with that Department. Another classification can be made on the nature of the studies, as follows:

1. Testing varieties--adaptation, maturity. . . . .	42
2. Breeding--selection, hybridization . . . . .	27
3. Diseases . . . . .	6
4. Insects	
5. Soil type - (topography)	
6. Seed-bed preparation	
7. Time of planting	
8. Method of planting--solid drilling vs. in rows	
9. Amount of seed per acre	
10. Inoculation. . . . .	11
11. Cultivation	
12. Physiology-Ecology . . . . .	13
13. Place of soybeans in the rotation. . . . .	42
14. Soil treatment . . . . .	44
15. Harvesting--for hay and seed . . . . .	3
16. Storage of seed. . . . .	6
17. Farm utilization--feeding. . . . .	119
a. Poultry. . . . .	53
b. Swine. . . . .	20
c. General. . . . .	17
d. Dairy cattle . . . . .	13
e. Turkeys. . . . .	9
f. Cattle . . . . .	5
g. Sheep. . . . .	2
18. Edible purposes--green vegetable, sprouts. . . . .	29
19. Cost of production . . . . .	4
20. Marketing	
21. Soybeans and soil conservation	
22. Industrial utilization--oil and other products . . . . .	7

In discussing some of the particular projects and groups of projects indicated above, Dr. Burlison pointed out that there are very few studies being made on specific phases of production, such as preparation of the seed-bed, method of planting, date and rate of planting, and cultivation. There are also very few projects involving the study of insect pests, but he predicted an increasing interest in this subject. He praised the program of disease studies being conducted by the U. S. Department of Agriculture.

Dr. Burlison also urged additional studies of hail injury and of the genetics of soybeans, and he concluded his remarks with a commendation of the work done by the Extension Service in carrying the results of research to farmers. He also complimented the soybean processors and the manufacturers of farm machinery for the contributions they have made to soybean production.

At this time Mr. Strayer announced that the next meeting of the American Soybean Association would be held at Columbus, Ohio, on September 4, 5, and 6, 1947. The first day will be devoted to field trips at the University, and the second two days will be used for formal meetings.



As part of the discussion of Dr. Burlison's paper, Dr. Woodworth also called attention to the lack of studies on genetics and the need for more work on the inheritance of characters which govern composition and other properties. Several representatives of other Experiment Stations were called upon, first of whom was Director Gardner, who stated that the work being done on soybeans at the Michigan Station is rather small. One of their developments is an oil-wax emulsion containing soybean oil which can be sprayed on certain crops to reduce their rate of transpiration. Dr. Quackenbush said that the work being done on chemical aspects of soybeans is not extensive at Purdue, particularly since the discontinuance of the work on phosphatides and sterols formerly conducted by Dr. Max H. Thornton. Dr. Albrecht, however, described in some detail the extensive research on breeding and cultural practices being conducted at Purdue.

Dr. Hughes described tests conducted at Iowa State on hail damage and also the breeding studies being conducted there.

Dr. Hamilton discussed his work which showed the necessity for heating soybean meal in order to increase its biological utilization. Methionine and cystine appear to be the limiting factors, and when feeding some animals it is necessary to add 0.15 percent of the former amino acid when soybeans comprise the only protein in the ration. When hogs are fed a ration consisting entirely of vegetable protein the addition of methionine is ineffective, but the addition of this component is of considerable assistance when added to poultry rations containing a certain amount of meat scraps.

"Report from the Bureau of Agricultural and Industrial Chemistry," by R. T. Milner, Northern Regional Research Laboratory:

Dr. Milner reviewed the history of soybean research in this Bureau, starting with the establishment of the U. S. Regional Soybean Industrial Products Laboratory in 1936. At that time suggestions were obtained from representatives of the entire soybean industry on the type of research to be undertaken, and these served as the original program of the Laboratory when it functioned at Urbana. The research has been altered to meet changing conditions and the desires of the industry since that time, and it has not been affected adversely by transfer of the chemical and engineering sections of the Soybean Laboratory to Peoria.

The studies being conducted at the Northern Regional Research Laboratory can be grouped into four general types:

1. Composition
2. Meal utilization and improvement
3. Oil utilization and improvement
4. Processing

Typical of the studies being conducted on the composition of soybeans was the work undertaken at the request of the Commodity Credit Corporation to assist the industry in obtaining accurate oil analyses as part of the program of

purchasing soybeans on the basis of their oil content. The Northern Regional Research Laboratory was able to assist the many laboratories conducting such analyses and to bring their results into agreement with those obtained elsewhere, with all parties being rather well satisfied.

The work on soybean protein has consisted in the development of new uses and the improving of present ones. For example, soybean oil meal is an ingredient in a new type of glue for plywood which shows great promise, and considerable success has been achieved in the use of soybean oil meal in molded types of plastics. Other work concerns the use of soybean protein in paper coatings, and considerable progress has been achieved in the use of protein in edible products, such as whips and meringues.

In the field of oil research, much progress has been made in the development of formulations for paints and varnishes containing appreciable quantities of soybean oil, and excellent results have also been obtained in the production of a substitute for tung oil. In addition, soybean oil has been converted into such products as Norepol, which is a rubber substitute, and Norelac, which is a resin suitable for coating special papers and in the formulation of protective coatings.

A great deal of the Laboratory's research on soybean oil is devoted to the flavor problem which was discussed by Mr. Truitt and Mr. Crapple on the previous day. One of the first steps toward solution of the problem was the organizing and training of a taste panel which can determine quite quantitatively the flavors of different oils. This has provided a useful tool for evaluating the results of experiments directed toward reproducing certain flavors and determining the causes of those which occur naturally.

Considerable progress has been made toward solution of the reversion question as the result of information obtained in a survey of European practices, particularly those in Germany. It was found that European refiners are able to make a soybean oil quite resistant to reversion if it is not hardened, but that the hard, or hydrogenated, product is organoleptically unstable. The European practice, therefore, is to use only unhardened soybean oil, mixing it with other hard fats to produce margarine. The use of this procedure in the United States is hardly practicable, but a study of the European methods for producing the unhardened oil with good flavor characteristics has pointed the way to what may be an eventual solution of the entire problem.

Among the so-called "processing" studies is the development of a method for extracting oil from soybeans with ethyl alcohol as the solvent. The meal thus produced has excellent color and flavor and should command a premium price for the production of both flour and various industrial proteins.

Another study being conducted in the pilot plant is that of fractionating soybean oil by the use of furfural as a solvent, employing liquid-liquid extraction. The process separates the oil into two products, one of which is an excellent drying oil and the other a considerably better-than-ordinary soybean oil for use in edible products.



Dr. Milner also pointed out the help that has been furnished to many branches of industry by members of the staff of the Northern Regional Research Laboratory who are experts in their particular fields and are therefore able to advise prospective users of soybean products and to furnish information about the soybean industry.

In discussing Dr. Milner's presentation, Dr. Burkison asked about the performance of various varieties of soybeans when processed. Dr. Milner replied that we have no information on this subject but that the Northern Regional Research Laboratory hopes to obtain some as a result of the work now being planned in cooperation with the Regional Soybean Laboratory. He discussed briefly, however, changes which do occur in soybeans while in storage during various seasons of the year.

Dr. Woodworth inquired about the commercial value of colored beans and was informed that the food industries have a distinct prejudice against such varieties for the production of flour. Mr. Johnson pointed out that black beans contain 2 to 4 percent more protein, but Mr. Bunnell stated that the trade in general dislikes meal from such beans because of the black particles in the product.

In conclusion, Mr. Goss summarized the problems which had been discussed by the respective speakers and which appear to need further research. Briefly, these are:

Mr. Brannan:

1. Devising of a rapid and simple method for determining the oil content of soybeans, suitable for use by country elevators; also the suggestion made by Mr. Scofield that methods be devised for segregating beans on the basis of the adaptability of the oil for industrial or food uses.

Mr. McLaughlin:

1. Further study of the preparation of seed-beds, such as disking without plowing and similar practices.
2. Development of better inoculants.
3. Study of the optimum manner for fitting soybeans into various crop rotations.
4. Investigation of such special problems as types of soil and topography of the fields.
5. Cultural practices, such as time of planting and width of rows.
6. Soil conservation practices, such as contouring.
7. The proper use of fertilizers so that a rotation including soybeans will not prove soil-depleting.
8. The best method of harvesting fields planted in various ways.
9. Studies of defoliation and hail damage.
10. The study of trace elements.
11. Improvement of storage practices.
12. Continuance of studies on the cost of production, such as those conducted by the Illinois Station.

Mr. Bunnell:

1. The need for more orderly marketing practices so that most of the crop will not be sold during the harvesting season.
2. The need for a good futures market in beans, oil, and meal.
3. Improvement of processing practices, directed particularly toward increasing the efficiency of extraction and the quality of the products.

Mr. Truitt and Mr. Crapple:

1. The necessity for solving the problem of reversion, or flavor instability.
2. Ascertaining whether certain varieties of soybeans yield oil of higher organoleptic quality, particularly the varieties containing oil of low iodine value.

Mr. Scofield:

1. Fundamental studies on the composition of the glyceride molecules in soybean oil.
2. Determination of the exact mechanism of the drying reaction which occurs when oils polymerize.

Dr. Hayward:

1. Determination of the exact factor to use in the case of soybean products, particularly soy flour, for converting nitrogen analyses to protein content.
2. Development of a means for expressing quantitatively the functions of soy flour in baked goods.
3. The study of various soybean varieties to determine which are best for the manufacture of soy flour.
4. Further studies on the manufacture of soy flour in order to improve its flavor and color, to decrease its content of thermophillic bacteria, and to raise its quality in other respects.
5. Development of better consumer acceptance for soy flour.
6. Additional studies on a proper method for feeding soybean meal, especially to swine and poultry.
7. Development of varieties which yield meals having better compositions from the standpoint of the feed industry, such as varieties containing higher percentages of methionine.

Northern Regional Research Laboratory  
March 28, 1947

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